RECEIVED
CENTRAL FAX CENTER
JUL 26 2007

REMARKS/ARGUMENTS

Claims 1-11 are presently pending in this application. Claim 12 has been canceled, and claims 13-19 have been withdrawn.

Independent claims 1 and 9 were principally rejected over Ballantine (6,740,437); claim 1 was rejected for anticipation, and claim 9 for obviousness when Ballantine is combined with the secondary Haltiner patent (6,967,064).

Independent claim 1 is for a method for operating a fuel cell in which air is added to the anode gas from the cell. The resulting mixture is then catalytically oxidized to form an effluent. In addition, claim 1 requires:

- thereafter heating the effluent during at least portions of the time when the fuel cell generates electricity, and
- heating the fuel cell with the effluent.

Independent claim 9 claims the present invention slightly differently from claim 1 and in relevant parts requires:

- flowing an effluent from the catalytic oxidizer to the fuel cell, and
- at least at times during the operation of the fuel cell heating the effluent from the catalytic oxidizer before the effluent reaches the fuel cell.

Claim 1 was rejected for anticipation because Ballantine was viewed as teaching to exhaust the fuel gas from a fuel cell to an oxidizer to form a combustible anode gas mixture, heating the anode gas as required so it can be oxidized in oxidizer "318" to form an effluent and further:

(1) heating the effluent by adding a supplemental supply of oxygen to oxidize combustibles which would increase the temperature of the effluent during portions of the time when the fuel cell is generating electricity; and

(2) heating the fuel cell with effluent by feeding the effluent to a heat exchanger which transfers heat back to the fuel cell by humidifying the air stream that is fed to the fuel cell (See Figure 3, column 10, lines 1-12 and 26 to 35).

Ballantine was applied against claim 9 in the same manner in which it was applied against claim 1. The Final Rejection acknowledges that Ballantine does not expressly teach exchanging heat between the air flow and the anode gas prior to mixing the air flow with the anode gas, but this was viewed as being supplied by the secondary Haltiner patent. Thus, claim 9 was rejected for obviousness.

There are fundamental differences between the present invention and Ballantine.

As is stated in paragraph [0001], the method of the present invention provides "additional heat that may be necessary for maintaining the minimum required fuel cell temperature". Ballantine lacks any disclosure concerning heating the fuel cell to maintain a minimum temperature. Ballantine is not concerned with heating the fuel cell and, therefore, lacks any disclosure relevant thereto.

However, heating the fuel cell is crucial because to "properly operate the fuel cell, it must first be heated with an external source of heat at least during its initial start-up phase and at times thereafter when heat generated by the reactions inside the fuel cell itself is insufficient for sustaining of the process" (paragraph [0003]).

In view thereof, the present invention is directed to a particularly efficient method for controlling the oxidation of the combustible product in the anode gas from fuel cells and supplying heat to the fuel cell when needed (paragraph [0007]).

The present application describes how this is attained, namely with a first, front burner that heats air as necessary upstream of the catalytic reactor and a second burner which "provides additional heat if the temperature of the effluent exiting the catalytic reactor is insufficient for normal fuel cell operation" (paragraph [0010]).

As the foregoing demonstrates, an important aspect of the present invention is to heat the <u>fuel cell</u> so that fuel cell operation can be sustained. The heat therefor is derived from the second heat exchanger as is reflected by independent claims 1 and 9.

In contrast to the present invention, Ballantine discloses a system, such as the one shown in Fig. 3, in which air, steam and fuel inputs 304, 306, 308 are converted into a reformate stream 310 in a fuel processor 302 that is flowed through a fuel cell stack 312 where it is reacted

at the anode electrodes of the fuel cells. Fuel cell 312 also receives oxygen that is reacted with the reformate stream in the fuel cell.

Spent reformate from the fuel cell is exhausted and fed to oxidizer 318 to remove any carbon monoxide, hydrogen or residual hydrocarbons in the exhaust. The oxidizer receives oxygen from the air exhausted from the fuel stack (column 9, line 58 to column 10, line 12).

The reformate exits the fuel processor at a temperature of about 200°C (column 10, line 20) and is then further cooled in a heat exchanger 332 to the fuel stack operating temperature of about 60-80°C (column 10, lines 21-22).

There is a heat exchanger 336 downstream of oxidizer 318 to extract heat from the oxidizer exhaust 334. Its operation is described as follows:

> For example, in some embodiments, a coolant can be circulated through heat exchanger 336 to transfer heat from the oxidizer to another part of the system 300, such as to <u>preheat</u> the air 304 and fuel 308 streams fed to the fuel processor 302. In other embodiments, water can be flowed through heat exchanger 336 to generate steam, which is then used to <u>humidify</u> the air stream 314 that is fed to the fuel cell stack, or to provide the steam flow 306 that is used in the fuel processor 302. (column 10, lines 27-36, underlining added)

There is no suggestion anywhere in Ballantine to use the heat extracted from the oxidizer exhaust 334 for maintaining the required temperature in the fuel cell stack.

This deficiency of Ballantine was brushed aside in the Final Rejection by asserting that Ballantine discloses "heating the fuel cell with the effluent [from oxidizer 318] by feeding the effluent to a heat exchange which <u>transfers heat back to the fuel cell by humidifying the air stream that is fed to the fuel cell</u> ...." (emphasis added). This observation is a skewed hindsight reconstruction of the prior art disclosed by Ballantine in view of what is disclosed in the present application.

Applicant resolutely traverses the assertion that Ballantine teaches or suggests to transfer heat from the oxidizer effluent to the fuel cell in any manner, or that such heat transfer is inherent in Ballantine's system.

What Ballantine discloses is to preheat air 304 or fuel 308 fed to the fuel processor or to humidify the air stream 314 that is fed to the fuel stack. Ballantine clearly distinguishes between heating and humidifying as the foregoing quotation from column 10 of Ballantine demonstrates. Heat recovered from the heat exchanger 336 is used to heat the air and fuel streams 304, 308 or to humidify the air 314 fed to the fuel cell. Ballantine nowhere states or suggests that humidifying the air also heats the fuel cell as required by claims 1 and 9.

It is clear to anyone skilled in the art that humidifying the air is not the same as heating air. Air can be humidified without changing its temperature or by raising or lowering its temperature. Ballantine also clearly and explicitly distinguishes between heating and humidifying. Heating the air by humidifying it is also not inherent because whether the air is heated, cooled or remains at the same temperature depends on conditions under which the air is humidified.

Not one word is devoted in Ballantine how the system needs to be implemented to maintain operation of the fuel cell stack during start-up or when heat generated inside the fuel cell is insufficient to sustain the process. One of ordinary skill in the art would further not recognize from Ballantine's disclosure that humidified air fed to a fuel cell is in any way desirable or sufficient to maintain the fuel cell at the required process temperature.

Thus, Ballantine does not teach or suggest adding heat to the air for the fuel cell, nor is the addition of heat to the air inherent since humidifying air is not the same and is not a function of heating the air. For at least this reason, claim 1 is not anticipated by Ballantine.

Claim 1 further requires "heating the fuel cell with the effluent". In Ballantine, the heat extracted from the oxidizer exhaust 334 is used in another part of the system "to preheat the air 304 and fuel 308 streams" or "to generate steam, which is then used to humidify the air stream" by circulating a coolant through heat exchanger 336 (column 10, lines 26-34). Whatever heat is recovered from the oxidizer exhaust is transferred to a coolant, such as water, but the exhaust or effluent itself "is vented to ambient via conduit 136" (column 5, line 59).

Thus, Ballantine contains no disclosure that the fuel cell is heated with the effluent. To the contrary, Ballantine teaches to transfer the heat from the oxidizer effluent to a

coolant. Thus, Ballantine's oxidizer effluent does not and cannot heat the fuel cell as required by claim 1.

For at least this further reason, claim 1 is not anticipated by Ballantine.

Accordingly, Ballantine does not disclose each and every element as set forth in claim 1, either expressly or inherently as required by *Verdegaal Bros. v. Union Oil Co. of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987), *cert. denied*, 484 US 827 (1987).

Claim 1 is therefore not anticipated by Ballantine.

Essentially the same applies to independent claim 9, which was rejected for obviousness over Ballantine in view of Haltiner.

In relevant parts, claim 9 requires "flowing an effluent from the catalytic oxidizer to the fuel cell". The effluent 334 of Ballantine's oxidizer 318 is <u>never</u> flowed to the fuel cell. Instead, it is flowed to heat exchanger 336, as was discussed above, and from there it is vented to the atmosphere, or "to ambient via conduit 136" (column 5, line 59).

Haltiner also nowhere discloses or in any form suggests to flow the effluent from the oxidizer or catalytic converter to the fuel cell.

Thus, the combination of Ballantine and Haltiner does not suggest to one of ordinary skill in the art to circulate the effluent from the catalytic converter back to the fuel cell for maintaining the temperature of the latter.

For at least this reason, claim 9 is not obvious over Ballantine in view of Haltiner.

Further, claim 9 requires "heating the effluent from the catalytic oxidizer before the effluent reaches the fuel cell".

No such heating of the effluent 334 from the oxidizer 318 of Ballantine before the effluent reaches the fuel cell is possible because Ballantine vents the effluent to the atmosphere so that it will never reach the fuel cell. Haltiner has no disclosure or suggestion whatsoever to provide what is missing from Ballantine in this regard.

Accordingly, one of ordinary skill in the art would not and could not perceive Ballantine and/or Haltiner as teaching or suggesting to heat the effluent from the oxidizer or catalytic converter before it reaches the fuel cell, because none of the references even contemplate such a flow of the effluent, much less do they contain any such disclosure or suggestion.

For at least this further reason, claim 9 is not obvious over Ballantine in view of Haltiner.

Claims 5 and 10, which depend from claims 1 and 9, respectively, require that the lengths of the first and second flow paths through which the anode gas and air flow are such that substantially all portions of the mixture have a temperature that is below the auto-ignition temperature of the oxidizable component in the anode gas. These claims were rejected over Ballantine and Haltiner because it was considered <u>implicit</u> in Haltiner that the flow paths "would be long enough so that no portions of the mixture would be above the auto-ignition temperature of the combustible components in the anode gas in order for combustible components to be catalytically oxidized inside the oxidizer instead of inside the flow paths". This is <u>not</u> implicit in Haltiner.

There is no indication in Haltiner that the respective lengths of the flow paths are such that no portions of the mixture would be above the auto-ignition temperature "in order for the combustible component to be catalytically oxidized inside the oxidizer instead of inside the flow paths" as asserted in the Office Action. There is no suggestion or indication of any type that auto-ignition is a problem in the fuel cell assembly disclosed in Haltiner or, if auto-ignition were to occur, that the flow paths have a length to prevent any oxidation along the flow paths and to instead limit them to the oxidizer. In the context of Haltiner, this observation is either speculation or hindsight reconstruction of the prior art. Neither is a proper basis for rejecting claims.

Accordingly, dependent claims 5 and 10 are not obvious over Ballantine and Haltiner. Claims 5 and 10 are therefore independently nonobvious and allowable over the art of record.

The remaining dependent claims 2, 3, 5-7 and 11 are directed to specific features of the present invention which are independently patentable. These claims are further allowable because they depend from allowable parent claims.

CONCLUSION

In view of the foregoing, applicant submits that all pending claims are not obvious and, therefore, are allowable. A corresponding notification at an early date is requested.

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at (415) 576-0200.

Respectfully submitted,

J. Georg Seka
Reg. No. 24,491

TOWNSEND and TOWNSEND and CREW LLP
Two Embarcadero Center, 8th Floor
San Francisco, California 94111-3834
Tel: (415) 576-0200
Fax: (415) 576-0300
JGS:jhw
61107491 v1